

**SUBSTITUTE**

***REMPLACEMENT***

**SECTION is not Present**

***Cette Section est Absente***

CA-934 224-A

ABSTRACT OF THE DISCLOSURE

A cast explosive primer cartridge is provided for use in down-the-hole blasting with low energy detonating cord and delay detonating cap. The cast explosive has a full length vertical hole through which the low-energy detonating cord is threaded and a closed well at one end into which the delay detonating cap is inserted. Both the hole and recess as well as the area between them at said one end of the cast explosive are lined with a material such as polyethylene, polyvinyl chloride, etc. resistant to damage by the detonation of low energy detonating cord. The cast explosive is also provided with at least one other full length vertical hole into which an upline of standard detonating cord is threaded.

This invention relates to the initiation of insensitive explosives and in particular to an explosive primer design for use with low energy detonating cord and delay action blasting caps.

In a system of blasting wherein a series of charges of relatively insensitive explosive are initiated in time delay sequence, there may be employed as the primary initiating means non-electric millisecond delay blasting caps which are in turn initiated by low energy detonating cord.

- 10 In such a system a detonating cord network consists of a main or trunk line of standard detonating cord with attached low energy detonating cord (LEDC) down lines which lead to millisecond delay caps in the boreholes. Each of the delay caps then passes into or is otherwise in contact with a primer charge, which primer charge is designed to set off the main charge of insensitive explosive. It is often preferred that explosive charges in boreholes be initiated by a primer placed near the bottom or foot of the borehole since when the explosive column is initiated near the bottom, the rock does not move so
- 20 readily and more of the energy is used in breaking rock before the pressure is relieved by gas escaping to the surface. It is believed that this down-the hole priming coupled with millisecond delay of initiation between adjacent charges or rows of charges produces an optimum in blasting effectiveness.

- In down-the-hole priming, especially in long or deep holes containing insensitive explosives, it is frequently desirable to employ additional primer charges above the bottom primer to ensure that the detonation is sustained throughout the column of explosive. Thus a deep hole charge of insensitive explosive such as an ammonium nitrate/fuel oil (ANFO)
- 30 mixture may have a principal primer in the foot of the borehole



and one or more additional primers towards the top of the borehole. The additional primers may be detonated by means of a standard detonating cord upline which is initiated by means of the principal primer in the foot of the borehole. Additional primers on an upline may also detonate an explosive in the upper part of the same hole where the explosive has been loaded in separated short columns or decks to reduce the explosive load.

10 In the initiation of a blast using a series of non-electric delay blasting caps which initiate primers at the bottom of the boreholes and subsequently secondary or insurance primers, a main trunk line of detonating cord is initiated by conventional means. The attached LEDC downlines are initiated by the exploding trunkline and in turn initiate the delay trains in the non-electric delay blasting caps adjacent to or embedded in primers at the bottom of the explosive filled boreholes. After the delay interval, the caps detonate and set off the primers which in turn initiate the explosive columns. A series of such charges may be arranged in a planned delay pattern by judicious selection of  
20 suitable delay blasting caps.

A necessity in the use of LEDC initiated down-the-hole non-electric delay blasting as described, is that both the column of explosive in the borehole and the primer charge not be disturbed or broken up by the detonation of the LEDC down line. While low energy detonating cord having less than about 10 grains of explosive per foot of length will not unduly disturb a column of explosive in a borehole, it has been found that the detonation of such a cord in contact with, for example,  
30 a cast pentolite primer, will damage or crack the primer and may result in detonation failure when the delay cap is subsequently initiated.

To overcome this problem and in accordance with the invention a primer cartridge is provided comprising in combination a cylindrical casing and a cast explosive primer composition within said casing, said cast composition being provided with a closed well at one end thereof adapted to receive a blasting cap and with a full length tunnel or hole adapted to receive and enclose a continuous length of low energy detonating cord, both said well and tunnel and the area between them at said one end of the cast composition being lined with a material resistant to damage by the detonation of low energy detonating cord, said cast composition being also provided with at least one other open vertical perforation adapted to receive and enclose a continuous length of standard detonating cord.

A preferred embodiment of the primer cartridge of the invention is illustrated in the accompanying drawing in which

Figure 1 is a cross-sectional longitudinal view of the primer cartridge of the invention, and

Figure 2 is a bottom end view of the primer.

Referring to the Figures of the drawing, there is shown a cylindrical cartridge casing 1, which may be heavy cardboard, plastic or metal, enclosing a cap sensitive cast explosive 2, such as composition B (60% RDX + 40% TNT) or pentolite (PETN + TNT) in solid cylindrical cast form. The solid cylindrical cast explosive 2 has a well or recess 3 in its bottom end containing a delay blasting cap 4 and a full length hole or tunnel 5 through which is threaded a length of low energy detonating cord 6 with one end inserted in said blasting cap 4. In order to protect the cast explosive from damage by the detonation of LEDC 6, well 3 and tunnel 5 have

their walls, lined with a plastic material having the form of tubes 7 and 8. At their lower end, said tubes 7 and 8 are integral with and extend through a flat circular plastic base 10 the important function of which is to protect the bottom area of the cast explosive, over which the LEDC 6 is looped. Reference numerals 11 indicate angular webs which are accessory in maintaining tubes 7 and 8 in substantially upright position with respect to circular base 10. The solid cylindrical cast explosive 2 is also provided with tunnel 12  
10 which does not need to be lined, of a size sufficient to receive therein a length of standard detonating cord 13. An optional full length tunnel 14 is shown in Figure 2 to allow retention of the standard detonating cord in the primer by looping its end through the second hole rather than by tying a knot in the end.

In use in the field, blasting cap 4 with its attached length of LEDC 6 is passed through tunnel 5 which is lined with tube 8 and is inserted back into well 3 which is lined with tube 7. The passage of cord 6 where it contacts  
20 the primer is covered by protective plastic tubes 8 and 7 and by the plastic base 10 joining the tubes. Upline 13 of standard detonating cord is passed through hole 12 to communicate with other primers placed elsewhere in the borehole. To prevent said upline from coming out of hole 12, its lower end may be knotted such as shown in the drawing or may be looped back through optional hole 14. The assembled primer may then be lowered to the foot or bottom of a borehole by means of LEDC 6 and upline 13. In order to permit the lowering of the assembled unit without it leaning too much one way or  
30 the other, it is advantageous that tunnel 5 be located close to the axis of the cylindrical cast explosive 2. LEDC 6 may be

Initiated from a detonating trunk line and in turn, cap 4, explosive 2 and upline 13 are detonated in sequence. The detonation of upline detonating cord 13 may be used to initiate insurance primers at other locations in the borehole.

The purpose of cartridge casing 1 is to hold the cast explosive 2 and protect it against accidental physical damage prior to use and said casing may be made of any material suitable for those purposes. For economic reasons it is preferred to use soft shells made of layers of heavy paper. It has been found, for instance, that 4-ply paper shells are suitable.

An essential feature of the primer cartridge of this invention is that the walls of tunnel 5 and well 3 as well as the area at the bottom of cast explosive 2, over which LEDC 6 is looped, are lined with a material resistant to damage from detonation of LEDC. Such material may be cardboard paper, rubber or preferably a synthetic resin or plastic such as polyethylene, polypropylene, polystyrene and polyvinyl chloride. The thickness of the lining must, of course, be such as to absorb and insulate the cast explosive from the energy liberated by the detonation of LEDC. As lining material, it is preferred to use low density polyethylene which has been found to be efficient at a thickness of 0.03 inch where LEDC containing 5 grains/foot of PETN is employed.

In the preferred embodiment shown in the drawing, the linings for tunnel 5 and well 3 are in the form of plastic tubes 8 and 7 having their lower ends integral with plastic base 10. It should be understood however that tubes 7 and 8 and base 10 can be fully separate from each other, the base 10 which could extend to cover the whole bottom surface of cast explosive 2 being essential only to the extent that it provides

a protective covering for the surface over which LEDC 6 is looped. The assembly comprising tubes 7 and 8 and base 10 such as shown in Figure 1 and wherein said base 10 covers the whole base of the primer cartridge is preferred because it can be made economically from a plastic material, preferably low density polyethylene, by casting or molding methods, the wall thickness being selected to resist rupture by the detonation of the particular LEDC used.

10 A suitable primer according to the invention would be, for example, of from about 2 1/2 inches to 4 inches in diameter and about 3 1/2 to 5 inches in length and contain 1 to 2 pounds of cast, cap sensitive explosive. A more sensitive explosive may constitute a core portion containing the cap well 3 and tunnel 5 while an outer annulus containing holes 12 and 14 for the detonating cord upline may be of less sensitive explosive. The core of the primer or the whole primer explosive may be any suitable cap sensitive material which can be prepared in cast form. Typical suitable explosives include composition B, pentolite, tetrytol  
20 (tetryl + TNT) and the like. The outer annulus, if of a less sensitive material, will preferably be TNT.

Preferably the cap well 3 and tunnel 5 are located close to the axis of the cylindrical cast explosive 2 and hole 12 (and 14, if necessary) is located near the outer periphery of said cast explosive. Ideally hole 12 will be as remote as possible from the areas of the cap and LEDC line.



The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A cast primer cartridge for use with low energy detonating cord and delay blasting caps comprising in combination a cylindrical casing and a cast explosive primer composition within said casing, said cast composition being provided with a tubular well at one end thereof adapted to receive a blasting cap and with an open vertical hole adapted to receive and enclose a continuous length of low energy detonating cord, both said well and hole and the area between them at said one end of the cast composition being lined with a material resistant to damage from detonation of low energy detonating cord, said cast composition being also provided with at least one other open vertical hole adapted to receive and enclose a continuous length of standard detonating cord.

2. A cast primer cartridge as claimed in Claim 1 wherein the lining material resistant to damage from detonation of low energy detonating cord is a plastic.

3. A cast primer cartridge as claimed in Claim 2 wherein the plastic is low density polyethylene.

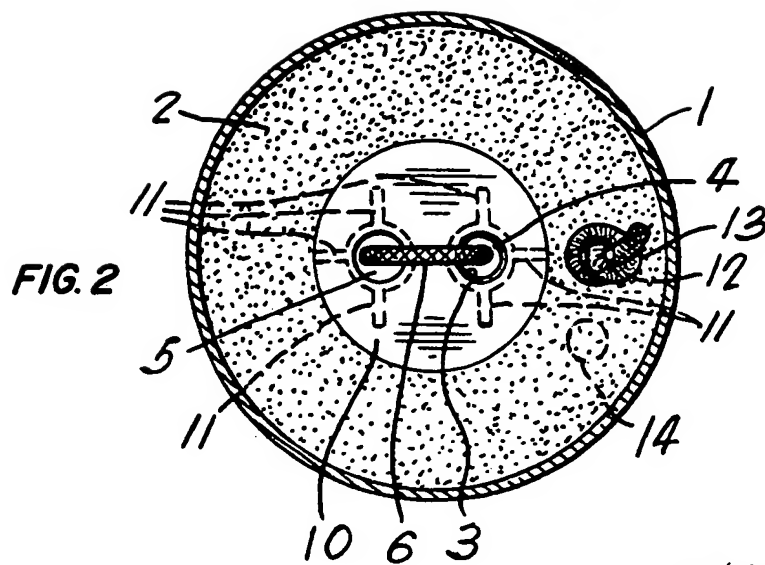
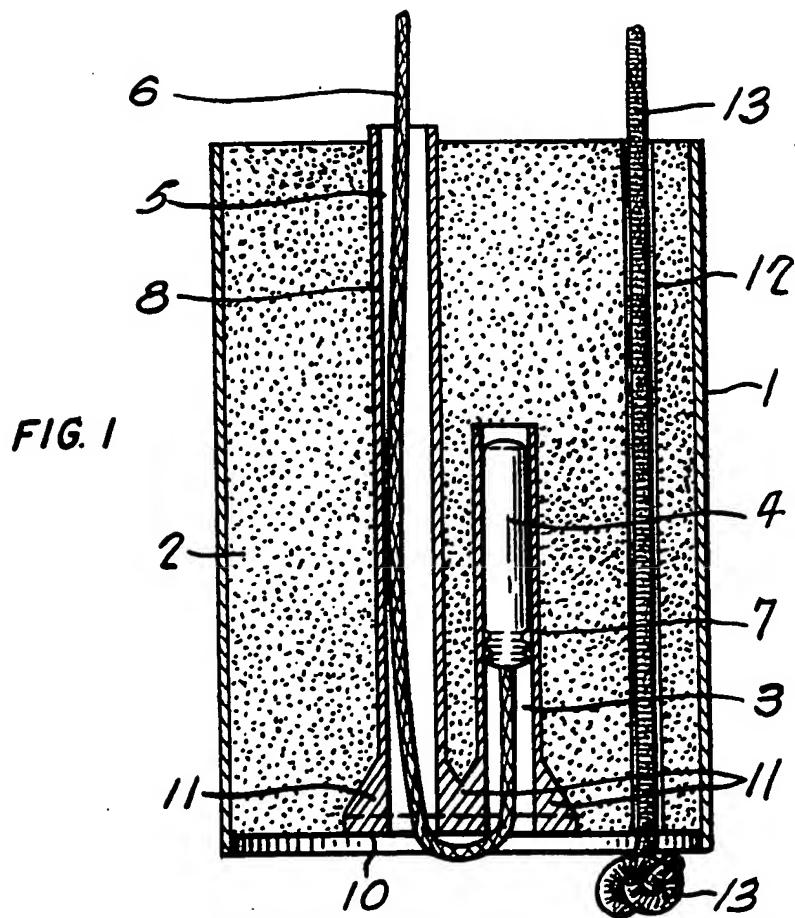
4. A cast primer cartridge as claimed in Claim 1, 2 or 3 wherein the cylindrical casing is made of multi-ply paper.

5. A cast primer cartridge as claimed in Claim 1, 2 or 3 wherein the cast explosive composition is selected from composition B, pentolite, tetrytol and mixtures thereof.

6. A cast primer cartridge as claimed in Claim 2 or 3 wherein the plastic lining is in the form of tubes integral at their lower end with a base which covers the area at the bottom surface of the cast explosive, extending between and around said tubes.

7. A cast primer cartridge as claimed in Claim 2 or 3 wherein the plastic lining is in the form of tubes integral at their lower end with a base which covers the whole base of the cast explosive.





INVENTOR:

G. TOWELL

PER: *Hydrovac*  
AGENT